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Prior Art 2

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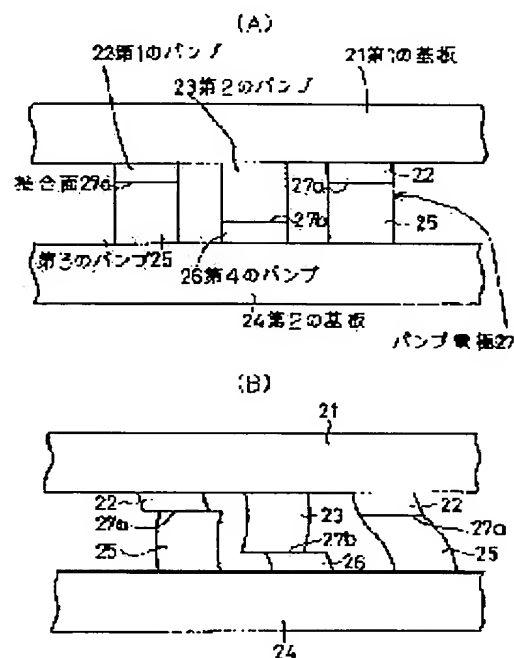
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(54) BUMP ELECTRODE FOR BOARD CONNECTION

(57)Abstract:

PURPOSE: To prevent mutual contact between adjacent bumps due to a thermal cycle with regards to a board connection bump electrode when connecting to a board by way of a bump.

CONSTITUTION: A first bump 22 and a second bump 23 installed to a first board 21 in two dimensions and a third bump 25 and a fourth bump installed to a second board 24 in two dimensions are formed in such a fashion that their length may be different from each other. The first bump 22 and the third bump 25, and the second bump 23 and the fourth bump 26 are contact-boarded in such a fashion that their bonded elevations may be different from each other. Under such conditions, the first board 21 may be electrically connected to the second board 24.



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[Claim(s)]

[Claim 1] While arranging in the predetermined position on the 1st substrate (21) by turns the 1st and 2nd bumps (22 23) from whom length differs at two dimensions the 2nd substrate (24) top -- this -- it being a position corresponding to the 1st and 2nd bumps (22 23), and with the 3rd bump (25) corresponding to this 1st bump (22) on this 1st substrate (21) The 4th bump (26) corresponding to this 2nd bump (23) is arranged. With this 1st bump (22), this 3rd bump (25), and this 2nd bump (23) The bump electrode for substrate connection characterized by changing the height of a plane of composition, being joined and this 4th bump (36) doing electric junction of the 1st substrate (21) of the above, and the 2nd substrate (24) of the above.

[Claim 2] Two dimensions arrange two or more bumps (14a, 14b) located in the lot (41) of the 1st substrate (21 12) and the 2nd substrate (24 13) by whole division drawing. In the bump electrode for substrate connection for carrying out electrical installation of this 1st substrate (21 12) and this 2nd substrate (24 13) through each of this bump (14a, 14b) The bump electrode for substrate connection characterized by changing a position and arranging this predetermined bump within the aforementioned lot (41) in order to acquire the distance between the aforementioned bumps (14a, 14b) who adjoin in the direction of a radial from the center of the above 1st and the 2nd substrate (21, 24, 12, 13).

[Claim 3] Two dimensions arrange two or more bumps (42a, 42b) located in the lot (41) of the 1st substrate (21 12) and the 2nd substrate (24 13) by whole division drawing. In the bump electrode for substrate connection for carrying out electrical installation of this 1st substrate (21 12) and this 2nd substrate (24 13) through each of this bump (42a, 42b) The bump electrode for substrate connection characterized by making this predetermined bump's cross-section configuration counter as a shorter side in this radial direction in order to acquire the distance between the aforementioned bumps (42a, 42b) who adjoin in the direction of a radial from the center of the above 1st and the 2nd substrate (21, 24, 12, 13).

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the bump electrode for substrate connection in the case of connecting with a substrate by the bump.

[0002] On a recent-years, for example, semiconductor, substrate, the substrate of the optoelectric-transducer section which has arranged two or more 2-dimensional photo detectors, and each signal-processing section for reading the signal by which photo electric translation was carried out is connected by the binding post (bump electrode), and the stuck hybrid type solid state camera is being used. Especially the infrared solid state image pickup device that detects an infrared linear light increases the number of pixels in recent years, and high resolution-ization is attained. In this case, since it will become impossible to use it if a defective pixel also generates a part among many pixels, a high thing of the reliability which a defective pixel does not generate even if the number of pixels increases, and endurance is desired.

[0003]

[Description of the Prior Art] Drawing for explaining the solid state camera which makes

connection by the conventional bump electrode to drawing 5 is shown. drawing 5 (A) -- a part -- a notch **** schematic diagram -- it is -- drawing 5 (B) -- a part of drawing 5 (A) -- it is a cross section

[0004] It sets to drawing 5 (A) and (B), and electric junction of the solid state camera 11 is carried out by the bump electrode 14 of plurality [section / signal-processing / 13 / the photoelectrical transducer 12 and].

[0005] Photodiode field 12b as which the photoelectrical transducer 12 detects infrared radiation on semiconductor substrate 12a of HgCdTe (mercury cadmium tellurium) is arranged at two dimensions. And bump 14a which deposited the indium (In) is formed in each of this photodiode field 12b.

[0006] On the other hand, signal read-out circuit 13b in which the processing circuit section 13 contains two or more pixel 13a which corresponds for example, on (Silicon Si) substrate at the above-mentioned photodiode field 12b is formed. Moreover, bump 14b which deposited the indium (In) is formed on each pixel 13a.

[0007] And each bump 14a of the photoelectrical transducer 12 and each bump 14b of the processing circuit section 13 are stuck by pressure, electrical coupling is performed, and the so-called hybrid type is constituted. An electron generates such a solid state camera 11 in the infrared radiation which carries out incidence to the photoelectrical transducer 12, and an electrical signal is sent to the processing circuit section 13 through the bump electrode 14 from photodiode field 12b.

[0008] Moreover, as for this solid state camera 11, being cooled and used is common in order to remove the unnecessary signal generated with the temperature which equipment itself has.

[0009]

[Problem(s) to be Solved by the Invention] By the way, since it is cooled by for example, liquid nitrogen temperature at the time of operation, whenever the above-mentioned solid state camera 11 is a room temperature, and it uses it at the time of an inoperative, the optical transducer 12 and the processing circuit section 13 will repeat contraction by temperature, and expansion. Drawing for here explaining deformation of the bump electrode in drawing 5 to drawing 6 is shown. Like semiconductor substrate 12a of above-mentioned HgCdTe, and the Si substrate 13, in the hybrid type solid state camera 11 which stuck the different-species substrate, since the coefficient of thermal expansion of each substrate 12a and 13 differs, distortion occurs by Bumps 14a and 14b. When many heat cycles are repeated, and Bumps 14a and 14b deform as shown in drawing 6 , and the knot portion 15 shifts, for example, bump 14a which adjoins in a contact portion, and 14b may contact. In this case, since the signal of two pixels which contacted is mixed, it will become a defective pixel 2 pixels. Thus, while repeating a heat cycle, un-arranging [which a defective pixel generates] is, and there is a problem of reducing the reliability of a solid state image pickup device and endurance.

[0010] This is a problem produced when connecting the substrates from which coefficient of thermal expansion, such as a high hybrid IC of not only the above-mentioned solid state camera 11 but a degree of integration, differs by the bump.

[0011] Then, this invention was made in view of the above-mentioned technical problem, and aims at offering the bump electrode for substrate connection which prevents contact between the bumps who adjoin according to a heat cycle.

[0012]

[Means for Solving the Problem] While the above-mentioned technical problem arranges in the predetermined position on the 1st substrate by turns the 1st and 2nd bumps from whom length differs at two dimensions a 2nd substrate top -- this -- the position corresponding to the 1st and 2nd bumps -- it is -- this -- with the 3rd bump corresponding to this 1st bump on the 1st substrate The 4th bump corresponding to this 2nd bump is arranged, and this 1st bump, this 3rd bump and this 2nd bump, and this 4th bump change the height of a plane of composition, and it is joined, and is solved by carrying out electric junction of the 1st substrate of the above, and the 2nd substrate of the above.

[0013]

[Function] As mentioned above, the height of a plane of composition is changed, the 1st and 2nd bumps arranged by two dimensions on the 1st substrate and the 3rd and 4th bumps arranged by two dimensions on the 2nd substrate are joined, and electric junction of the 1st and 2nd substrates is performed.

[0014] Thereby, even if a position gap occurs in each bump's plane of composition under the influence of a heat cycle, the height of each bump's plane of composition differs, and it becomes possible to prevent adjoining bump inter-electrode contact.

[0015]

[Example] The block diagram of the 1st example of this invention is shown in drawing 1 . Drawing 1 (A) is a partial flank block diagram, and drawing 1 (B) is the schematic diagram of the bump electrode deformation in a heat cycle.

[0016] In drawing 1 (A), on the 1st substrate 21, the 1st bump 22 with short length and the 2nd bump 23 with long length are stationed by turns, and are arranged by two dimensions.

[0017] On the other hand on the 2nd substrate 24, the 3rd bump with long length (the same length as the 2nd bump 23) and the 4th bump 26 (the same length as the 1st bump 22) with short length are stationed by turns, and it is arranged at two dimensions. In this case, the 3rd bump 25 is equivalent to the 1st bump 22 of the 1st substrate 21, and the 4th bump 26 is equivalent to the 2nd bump 23.

[0018] and while making the 1st bump 22 of the 1st substrate 21, and the 3rd bump 25 of the 2nd substrate 24 correspond, make the 2nd bump 23 and 4th bump 26 correspond, it is made to join by sticking by pressure, and the bump electrode 27 is formed, respectively -- making -- this -- electric junction of the 1st and 2nd substrates 21 and 24 is carried out In this case, plane-of-composition 27a of each joined bump electrode 27 becomes different height from plane-of-composition 27b of the adjoining bump electrode 27.

[0019] Here, when heat stress is added to the 1st and 2nd substrates 21 and 24 by which electrical coupling was carried out by this bump electrode 27 by the heat cycle, as shown in drawing 1 (B), contraction and expansion are repeated and a position gap occurs in the planes of composition 27a and 27b of the bump electrode 27. However, from the height of the planes of composition 27a and 27b of the adjoining bump electrode 27 differing, as shown in drawing 1 (B), even if it produces a position gap in the above-mentioned planes of composition 27a and 27b, contact of each bump electrode 27 can be prevented.

[0020] The solid state camera which shows this to drawing 5 , and by applying to a hybrid IC etc., generating of a defective pixel, a defective electrode, etc. can be prevented and the reliability of equipment and endurance can be raised.

[0021] Then, drawing for explaining manufacture of drawing 1 to drawing 2 is shown. In

drawing 2 , first, resist 31a is applied on the semiconductor substrates (you may be any of the 1st or 2nd substrate 21 and 24) (24) 21, such as HgCdTe to which processing of predetermined field formation etc. was performed, and Si, and opening of the portion in which a bump electrode is located by photoetching is carried out (drawing 2 (A)).

[0022] And the vacuum evaporation of the indium (In) is carried out to a part for opening (drawing 2 (B)). Furthermore, resist 31b is applied and opening of the portion equivalent to the 2nd and 3rd bumps 23 and 25 with above-mentioned long length is carried out by photoetching (drawing 2 (C)).

[0023] Then, the vacuum evaporation of the indium (In) is carried out to a part for this opening (the 2nd (the 3rd) bump 23 with long length (25) and the 1st (the 4th) bump 22 with short length (26) are formed on the semiconductor substrate 21 (24) by removing drawing 2 (D) and Resists 31a and 31b (drawing 2 (E)).).

[0024] And that from which the height of a plane of composition differs between the adjoining bump electrodes 27 is formed by making the semiconductor substrates 21 and 24 formed in this way stick by pressure by bumps, as shown in drawing 1 (A).

[0025] Next, the block diagram of the 2nd example of this invention is shown in drawing 3 . Drawing 3 shows and explains the plan of the photoelectrical transducer 12 by making the solid state camera 11 as shown in drawing 5 into an example. In addition, also in the high hybrid IC of not only a solid state camera but a degree of integration, it is the same.

[0026] In drawing 3 (A), it is formed by the semiconductor substrate of HgCdTe and the photoelectrical transducer 12 as the 1st substrate 21 is formed in [the partition 41 equivalent to each pixel] two dimensions. And among each partition 41, a position is changed within a lot 41 in four sides, and bump 14a is arranged in the partition 41 (slash portion) located (three sides omit) at them. This bump 14a is arranged so that the distance between bump 14a which are the radiation-like direction and adjoin from the center of the semiconductor substrate 12 may be acquired.

[0027] Moreover, although not illustrated, corresponding to arrangement of bump 14a of the semiconductor substrate 12, bump 14b is arranged on the semiconductor substrate of the processing circuit section 13 as the 2nd substrate 24, for example, Si, (refer to drawing 5). And as shown in drawing 5 , sticking-by-pressure junction of bump 14a and the 14b is carried out, and electrical coupling of each substrates 12 and 13 is performed.

[0028] Here, if the heat stress by the heat cycle is added to the semiconductor substrate 12 as shown in drawing 3 (B), this semiconductor substrate 12 will repeat contraction and expansion in the direction of a radial, the direction of an arrow, i.e., the substrate center, of drawing 3 (B), and the plane of composition 15 of the bump electrode 14 will produce a position gap in the direction of an arrow. the field 42 of a slash portion [in / a part for a substrate periphery / in the amount of distortion in this case] -- it becomes large about a-42d That is, when the bump electrodes 14 arranged in the partition 41 located in these fields 42a-42d are regular intervals, it is easy to produce the contact whose amount of distortion of a plane of composition 15 is between the bump electrodes 14 greatly.

[0029] Therefore, as shown in drawing 3 (A), contact between the bump electrodes 14 can be prevented by arranging between bump 14a (14b) prepared in the partition 41 located in Fields 42a-42d so that distance may be lengthened in the direction of an arrow.

[0030] In addition, such bumps' 14a and 14b formation should just make the portion in which resist 31a in drawing 2 (A) and (B) carries out opening reposition by the mask

pattern.

[0031] Next, the block diagram of the 3rd example of this invention is shown in drawing 4 . Also in drawing 4 , the plan of the photoelectrical transducer 12 is shown and explained like drawing 3 by making the solid state camera 11 as shown in drawing 5 into an example. In addition, the explanation is omitted about the same portion as drawing 3 .

[0032] It is what made the cross-section configuration of bump 42a (illustration is omitted using the bump who counters as 42b) formed in the lot 41 of the semiconductor substrate 12 in drawing 4 the ellipse which has a shorter side and a long side, and bump 42a formed in the partition 41 arranged in the direction of an arrow shown in drawing 3 (B) is arranged so that a shorter side may counter and it may be located in this arrow direction. That is, it arranges so that distance may be lengthened between bump 42a (42b) which adjoins in this arrow direction.

[0033] Thereby, like drawing 3 , even if it produces a position gap in a plane of composition bump inter-electrode with the influence of a heat cycle, contact can be prevented.

[0034] In addition, a rhombus and a rectangle are [that what is necessary is just to have a part for a part for the short side part on which the cross section spreads abbreviation etc., and a long side] sufficient although the 3rd above-mentioned example showed the case where the cross-section configuration of bump 42a (42b) was made into an ellipse.

[0035] Moreover, even if it is the 3rd example, manufacture of the bump of the cross-section configuration concerned can be formed by changing the configuration of a mask pattern like drawing 3 .

[0036]

[Effect of the Invention] as mentioned above, according to this invention, change by turns the height of a plane of composition of the bump electrode which performs electric junction between substrates by junction -- or change arrangement -- or even if it produces a position gap in a plane of composition under the influence of a heat cycle by making between shorter sides counter in the cross-section configuration, adjoining bump inter-electrode contact can be prevented

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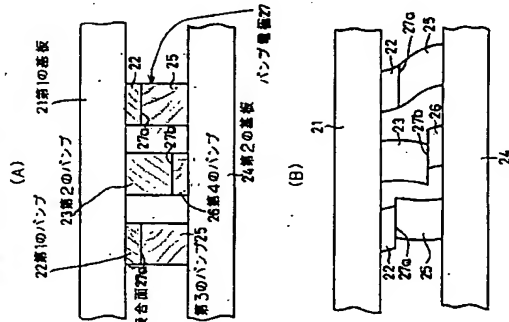
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(54)【発明の名称】 基板接続用パンプ電極

(57)【要約】
【目的】 本発明はパンプにより基板に接続を行う場合の基板接続用パンプ電極に關し、熱サイクルにより隣接パンプ間の接触を防止することを目的とする。

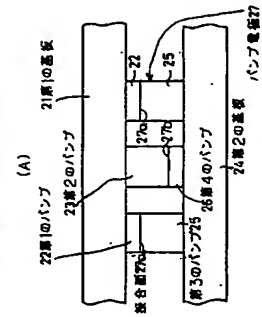
【構成】 第1の基板21上に二次元に配設された第1及び第2のパンプ22、23と、第2の基板24上に二次元に配設された第3及び第4のパンプ25、26とを、長さ異ならせて形成させる。そして、第1のパンプ22と第3のパンプ25、及び第2のパンプ23と第4のパンプ26を重畳接合させ、接合面の高さを変化させて第1及び第2の基板21、24の電気的結合を行なう。

本発明の第10の実施例の構成図



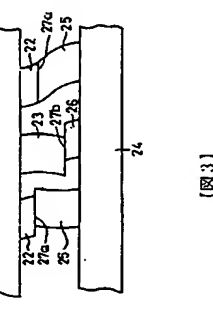
【図1】

本発明の第1の実施例の構成図



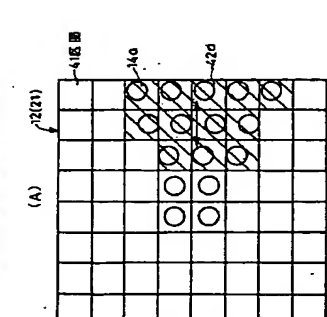
【図2】

図1の製造を説明するための工程図



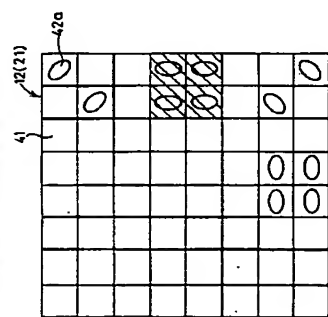
【図3】

本発明の第2の実施例の構成図



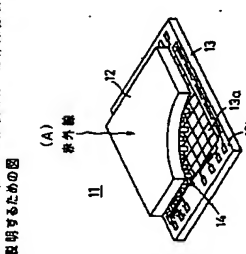
【図4】

本発明の第3の実施例の構成図



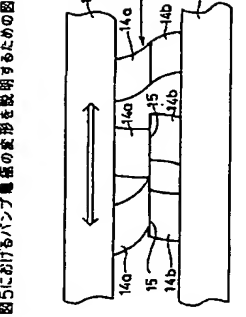
【図5】

従来のパンプ電極による接合を行う固体薄膜装置を説明するための図



【図6】

図5におけるパンプ電極の変形を説明するための図



フロントページの続き

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